

REMARKS

Claims 1-3 remain pending after this response.

Claim Amendments

By this amendment, claim 3 (directed to the non-elected invention) is canceled. Claim 1 is amended to clarify the claimed invention. Support for the claim 1 amendments resides at least at paragraph [0058] of the specification. No new matter is added by this amendment.

Rejection under 35 USC 102(b)

Claim 1 stands rejected under 35 USC 102(b) as being anticipated by Nakamura et al EP 999 640. This rejection respectfully is traversed to the extent deemed to apply to the claims as amended.

By way of review, claim 1 is directed to a method for the formation of a single-crystalline aluminum nitride film comprising the steps of nitriding a single-crystalline α -alumina substrate to form an aluminum oxynitride layer and an aluminum nitride film on the aluminum oxynitride layer.

It is important to recognize that, with respect to the claimed method, (1) the substrate to be nitrided is comprised of a single-crystalline α -alumina substrate, and (2) both an aluminum oxynitride layer and an aluminum nitride film on the aluminum oxynitride layer are produced by nitriding the single-crystalline α -alumina.

Further, (3) the single-crystalline aluminum nitride laminated substrate, comprising the single-crystalline α -alumina substrate, an aluminum oxynitride layer formed on the substrate, and a single-crystalline aluminum nitride film as the outermost layer are produced by the noted nitriding step. See paragraphs [0010-0011] at page 4 of the present specification in this regard. Also, (4) the density of dislocation in the single-crystalline alumina nitride is $10^8/\text{cm}^3$ or less (see paragraph [0010] of the specification).

The cited Nakamura et al reference fails to anticipate the invention of claim 1.

Nakamura et al is directed to a method for the manufacture of a substrate comprising a sapphire single crystal substrate, a buffer layer on the sapphire single crystal substrate, and an aluminum nitride single crystal layer on the buffer layer formed by depositing by MOCVD the buffer layer on the sapphire single crystal substrate, and then depositing by MOCVD the aluminum nitride single crystal layer on the buffer layer. The buffer layer is comprised of a material selected from the group consisting of gallium nitride and aluminum-gallium nitride.

The method disclosed by Nakamura et al thus involves the formation of a buffer layer and the aluminum nitride layer on the sapphire substrate (in this order) by MOCVD. The inventive concept of Nakamura et al at least differs from that of the claimed invention in that the claimed invention does not involve the use of deposition by MOCVD.

Further, in Nakamura et al, a substrate having a buffer layer of gallium nitride or aluminum-gallium nitride is formed between the sapphire single crystal substrate and the aluminum nitride layer. In the present invention, a multi-layered substrate having an aluminum oxynitride layer is produced which differs from the noted buffer layer between the single crystal α -alumina layer and the aluminum nitride layer. The Nakamura et al product thus differs from the claimed invention.

The Examiner states at page 6 of the Action that "it is noted that the features upon which applicant relies (i.e., the aluminum nitride layer is formed directly on the AlNO film (p. 4) are not recited in the rejected claim(s)." The Examiner further states at page 6 that "it is noted that the features upon which applicant relies (i.e., crystalline AlNO (p.4) are not recited in the rejected claim(s)."

In response to the above comments of the Examiner, applicants amend claim 1 to state (1) that the aluminum nitride layer is formed "directly" on the AlNO film, and (2) that the AlNO layer is "crystalline".

Applicants accordingly believe that the pending claims are now commensurate in scope with the arguments presented in support of patentability, while more clearly distinguishing over the teachings of the prior art.

The rejection is thus without basis, and should be withdrawn.

Rejection under 35 USC 103(a)

Claim 2 stands rejected under 35 USC 103(a) as being unpatentable over Nakamura et al EP '640 in view of Bolt U.S. Patent No. 4,857,246. This rejection respectfully is traversed.

The Examiner's continued conclusion is incorrect that "Nakamura et al discloses all of the limitations of claim 2, as discussed previously, except Nakamura et al does not teach the substrate is nitrided by heating in the presence of carbon, nitrogen and carbon monoxide."

As previously discussed at pages 3-5 of this response, Nakamura et al is similar to the invention of claim 1 only with respect to point (1) above - points (2)-(4) are neither taught nor suggested by the reference. Further, in view of the above-discussed amendments of claim 1, Nakamura et al is further distinguished from the claimed invention.

The additionally-cited Bolt reference does not cure the deficiencies of Nakamura et al.

Bolt discloses a method of manufacturing aluminum nitride by heating aluminum oxide in the presence of carbon and nitrogen (known as "reduction nitridation"), and fails to disclose or suggest the above points (1)-(4) of the present invention.

For instance, Bolt aims to convert all aluminum oxide into aluminum nitride, with the reaction temperature preferably being as high as possible in an atmosphere of 100% nitrogen.

Example 2 of Bolt describes the thus-formed aluminum nitride as being porous and comprised of elliptic particles as large as

25 to 40 microns. According to Bolt, aluminum oxide and solid carbon are mixed together in advance, and it is accordingly clear that a fine aluminum nitride film having excellent crystallinity (as in the present invention) is not obtained.

The combined teachings of Nakamura et al and Bolt thus cannot result in the claimed invention.

The rejection is without basis and should be withdrawn.

Double Patenting Rejection

Claims 1-2 stand rejected on the ground of obviousness-type double patenting in view of claim 3 of U.S. Patent application No. 10/937,344. This rejection respectfully is traversed.

The Examiner's conclusion is incorrect that the respective sets of claims are not patentably distinct.

In this regard, applicants note that claim 3 of the co-pending application requires the presence of carbon, nitrogen and carbon monoxide during the nitriding step, with the nitriding also being required to occur under specific reaction conditions. None of the noted limitations in claim 3 of the co-pending application reside in rejected claim 1, or are disclosed in the instant specification.

Applicants further note that, of the two applications, the instant application is the first-filed application. As the present application is believed to be in condition for allowance, the Examiner is requested to issue this application while

directing his attention to any double patenting issue in the second-filed application.


The rejection is thus improper and should be withdrawn.

In view of the above, the application is believed to be in condition for allowance.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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